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THE CLEAR HILLS IRON DEPOSITS

SPECIAL INFORMATION REPORT NO. 7

FOREWORD

This paper is one in a series of information papers published by the Peace River Regional Planning Commission.

The purpose of the series is, through the Commission membership, to present information to the residents of the region on matters which may affect their future well-being. The object of the individual papers is to generate a high level of informed public discussion on these matters with a view to determining the need for actions of a planning nature. Because of this, no explicit planning recommendations are made by Commission staff in the information papers. Instead it is hoped that the region's public, individually or collectively, will take the information, evaluate it on the basis of their own feelings and experiences, and from it generate their own courses of action and planning recommendations. Such recommendations may then be directed to the Commission and other public authorities in the region. In some cases it may be anticipated that the recommendations will necessitate the undertaking of substantially more research than was embodied in the information paper. In this way a major research report can be undertaken, such as those done in the past on central places in the region, the economic base, outdoor recreation and tourism, and the goals and objectives of the region's residents. Staff planning or policy recommendations would form a part of such a report to the extent of responding to the requests that led to the initiation of the major study.

To date the information paper series has covered general topics such as Communications in the Peace River Region of Alberta; Provincial - Municipal Finance: The Tax Sharing Issue and Intermunicipal Cooperation; The Dunvegan Dam Studies; and Soil Erosion in the Peace River Region, as well as an information paper on The Peace River Oil Sands. This paper, The Clear Hills Iron Deposits, is therefore the second in a series dealing specifically with the natural resources of the region.

Ian Wight
Senior Research Planner
Peace River Regional
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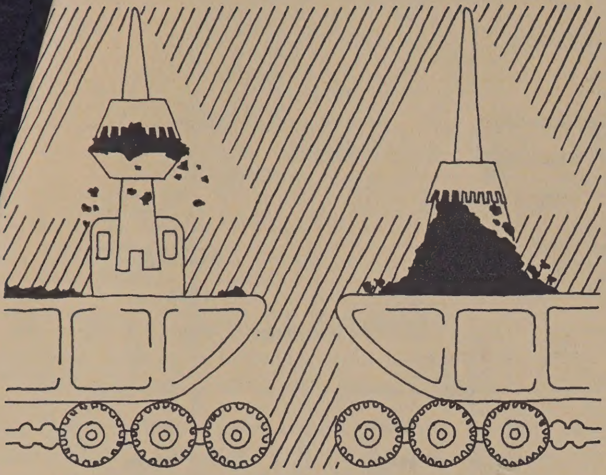


INTRODUCTION

The resources of the Peace River region are many and varied, and their ultimate exploitation will undoubtedly have a significant effect on the pattern of human settlement in the region. There is, however, an unfortunate preponderance of rumours and misconceptions about how, when, and by whom these various resources will be developed, and what their impact will be in both environmental and socio-economic terms. It is partly to dispel these rumours and answer these questions that this series of information papers has been produced by the Peace River Regional Planning Commission.

One of the most talked-about but least understood resources in the region is the deposit of low-grade iron ore found in the Clear Hills north of Worsley; as will be seen in the following pages, how this deposit will be exploited, or even whether it will be exploited, is a matter of some question. In order to avoid unnecessary and dangerous speculation, however, it is essential that the regional population be made aware of the nature of the deposit, and of which communities are likely to bear the brunt of the impact if it is ever exploited.

The big question mark with the deposit is how to economically upgrade the ore. Major research efforts on such a process are presently underway by the federal government, as well as by the Alberta Research Council. A report on the progress of these projects is due in the late summer of 1976, and we will pass on news of any breakthroughs by an addendum to this paper, or by an article in our monthly newsletter, "People, Plans and the Peace."

If you have any questions regarding the Clear Hills deposits and their future, feel free to write or phone, and we will do what we can to find an answer for you.

Conrad Boyce
Research Planner
P.R.R.P.C.

Western Canada~Iron Ore and the Steel Industry

The "Peace River Iron Deposits," located in the Clear Hills north of Worsley, are generally regarded, on the basis of grade and volume, as the best potential source of iron ore in the four western provinces. This, unfortunately, is not saying a great deal. There are deposits of much better grade, and much larger volume, in other parts of Canada and the world and the difficulties in upgrading the Clear Hills "ore"[1] anywhere have made it a low priority in the steel industry.

To this point in time, the steel industry in the prairie provinces has depended mainly on scrap as a source material (with some importation of iron ore pellets from the east). But three recent trends have brought the Clear Hills deposit back into focus:

1. A shortage of scrap
2. An upswing in prices for finished steel
3. Improvements in techniques for upgrading or "beneficiation" of low-grade ore such as that found in the Clear Hills

These developments have sharpened interest, both in government and industry, towards the establishment of an integrated steel industry in Alberta or the prairies as a whole. An integrated industry, of course, requires the raw material, and for several reasons, the Clear Hills deposit is the most attractive possibility. The alternatives:

1. Choiceland, Saskatchewan (50 miles east of Prince Albert) -- this deposit is small and of no better grade than Clear Hills ore. Its primary liability, however, is that it is buried beneath 2,000 feet of hard bedrock overburden. Underground mining is an expensive proposition.

2. Neepawa, Manitoba (100 miles west of Winnipeg) -- A similar deposit to Choiceland, with slightly better grade (35% Fe), but buried beneath 2,500 feet of bedrock overburden.

3. Crowsnest Pass, Alberta -- A deposit of widely variable grade, and few reserves scattered over several localities.

4. Lodestone Mountain, B.C. (15 miles west of Princeton) -- a fairly large deposit, but of very low grade (15 per cent iron, as opposed to 30 per cent in the Clear Hills).

5. Snake River, Yukon (130 miles north-east of Mayo) -- an immense high-grade deposit, but too remote to be developed in the near future.

6. Northwestern Ontario -- Several major low-grade deposits (25-30% Fe) exist in the region 200 miles northwest of Thunder Bay. These deposits

.ve high potential, but need major capital invest-
ent to start development.

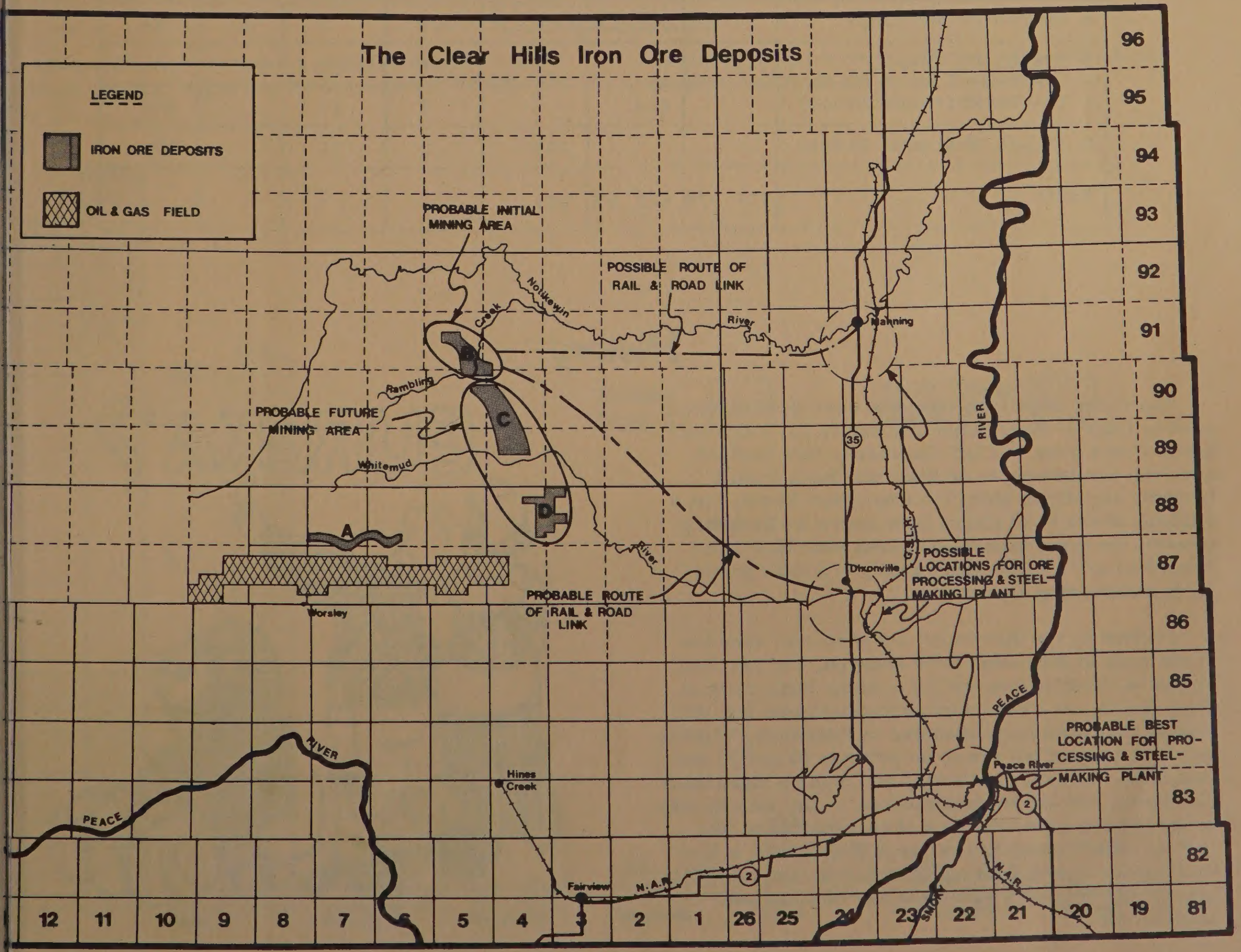
In addition, there are several producing mines
ong the B.C. coast. These have small amounts of
oven reserves, and are already committed to mar-
ts in Japan. Therefore, for reasons of grade,
lume, and accessibility, the Clear Hills deposit is
e first choice as the base for an integrated steel
dustry in the prairies. Spurred by this, the pro-
ncial and federal governments have jointly under-
ken a major research program (detailed later in
is paper), aimed at solving what to this point has been the major problem with the Clear Hills ore -- the difficulty of economically upgrading the ore to the point where it can be used in steel-making processes.

This research program is due to be completed in the late summer of 1976. At that time, we will all have a better idea of what is likely to happen in the Clear Hills in the future.

[1] Strictly, the term ore should be used only for materials that can be mined and processed at a profit. The Clear Hills material has not yet been proven developable; however, we refer to it as ore for lack of a more specific term.

The Clear Hills Iron Deposits

The "Peace River iron deposits," as they are
own in provincial and national circles, are located
several parts of the Peace River region. Small,
ry low grade material is found near Spirit River,
d a thin bed of better grade iron-bearing sandstone
present in the area between Gordondale and Blue-
rry Mountain. But the thickest and most extensive deposits underly the eastern and southern parts of th
Clear Hills, about 50 miles northwest of Fairview (see map). Scattered showings of iron-bearing sandstone also are found north and northwest of the Notikewin River, but these have not been explored in de
tail.


The Clear Hills Iron Ore Deposits
LEGEND
▨ IRON ORE DEPOSITS
▨ OIL & GAS FIELD
PROBABLE INITIAL MINING AREA
POSSIBLE ROUTE OF RAIL & ROAD LINK
Notikewin
Creek
River
Manning
Rambling
PROBABLE FUTURE MINING AREA
Whitemud
River
A
B
C
D
Worsley
PROBABLE ROUTE OF RAIL & ROAD LINK
35
RIVER
Dixonville
G.S.L.R.
POSSIBLE LOCATIONS FOR ORE PROCESSING & STEEL-MAKING PLANT
PEACE
PROBABLE BEST LOCATION FOR PROCESSING & STEEL-MAKING PLANT
Peace River
2
Hines Creek
Fairview
N.A.R.
PEACE
RIVER
SMOKY
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The Clear Hills deposits have been explored in four areas or blocks. The following table presents some relevant information, comparing the four blocks:

Although the A block is the most accessible of the four deposits, the iron-bearing bed is fairly thin, and much of it has too thick an overburden cover to be economically mineable. Although shown as a continuous band on the map, block A is actually a series of discontinuous sub-blocks, separated by erosional channels filled with glacial deposits. Block B, because it contains much larger proven reserves, is likely to be the first mine site.

As for blocks C and D, additional drilling is necessary to confirm the extent and grade of the iron bed in these areas. Except for Block D, all these deposits are held under a provincial iron lease by Imperial Metals and Power Ltd. of Vancouver. Lease No. 3, or A block, is 7,120 acres; Lease No. 4 (B block) 6,816 acres; and Lease No. 5 (C block) 12,020 acres. Imperial must pay one dollar per acre per year to retain the lease on these deposits. Accordingly, the company recently gave up two other leases, one of Block D and the other at an almost unexplored site by Moonshine Lake northwest of Spirit River, thereby saving an expense of $14,000 per year.

Block	Reserves (Millions of Tons)			Number of Drillholes	Average Thickness of Iron Bed	Average Grade (percentage of iron)	Maximum Thickness of Overburden
	Proven	Probable	Possible				
A (North of Worsley)	25 3/4	8 1/4		120	8	33	65
B (Rambling Creek)	201			115	22	34	130
C (North Whitemud River)		684		8	17		200
D (South Whitemud River)			205	2	11		200
TOTAL	226 3/4	692 1/4	205				

History

The Clear Hills Iron Deposits were first discovered in 1924 by three homesteaders in the Fairview-Hines Creek area -- Cliff Chalmers, Rod Redfern, and John Lundstrom -- on their way back from a trapping expedition along the Chinchaga River. On a cliffside above Swift Creek (now known as Rambling Creek), the three men encountered what they later described as "a mountain of iron" -- a dark green rusty outcropping of iron ore.

Excited by the discovery, the men sent samples of the rock to Edmonton to be assayed, and resolved to return the following spring to stake their claims. They did so, on a two-month expedition into the wilderness, and sent more samples to Edmonton, reports on which showed the ore to be between 30 and 35 per cent iron. The men knew they had made a significant discovery, but for several reasons -- the remoteness of the deposit area, the lack of transportation (the railway didn't reach Hines Creek until 1930), a lack of demand for new sources of iron ore, and a lack of money -- they didn't undertake any development themselves.

In fact, the deposits were virtually forgotten for most thirty years -- no publicity reported the dis-overy, no claims were registered. In 1953, the hillips Petroleum Company was drilling in the Swift reek area, and traces of iron-bearing minerals ere found. Interest was quickly and dramatically -awakened. New test holes were drilled, and the tention of a number of groups was attracted, inclu-ng the Alberta Research Council.

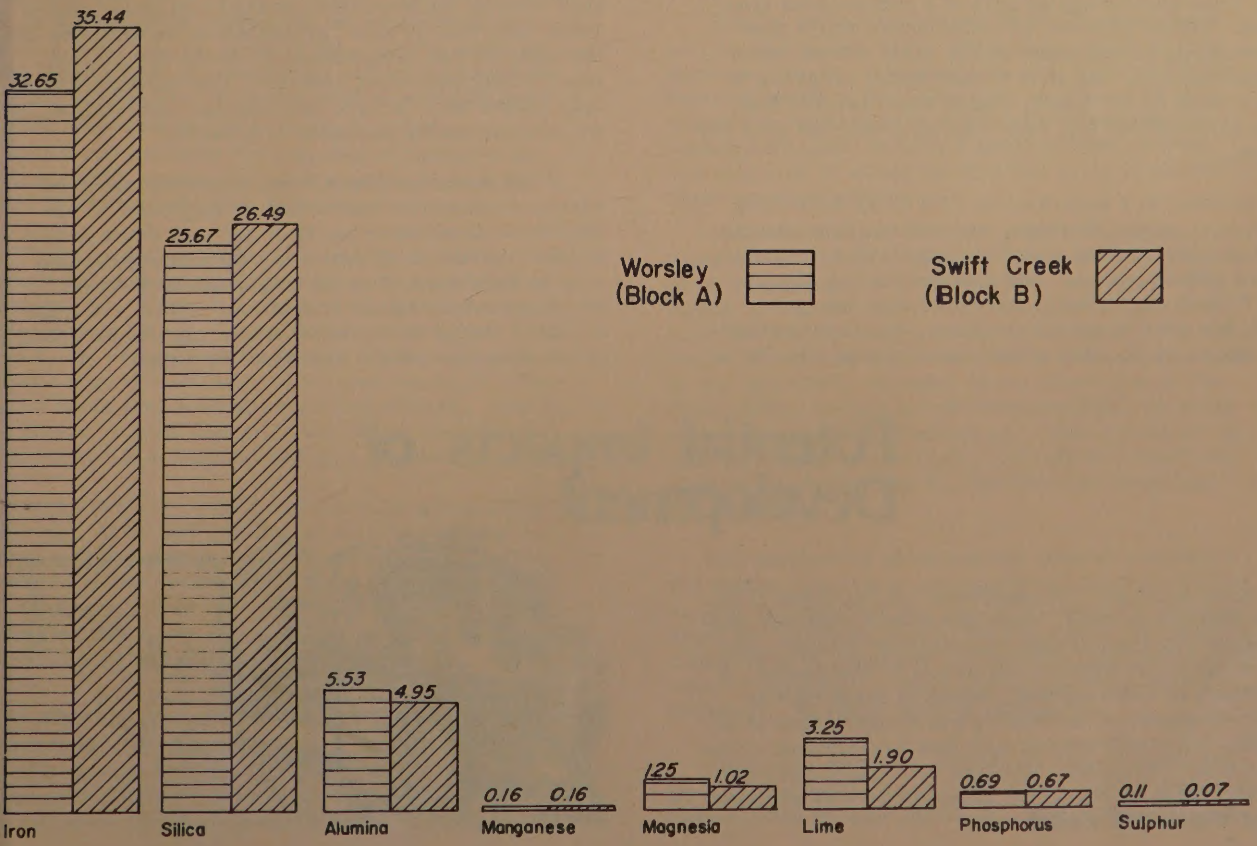
Chalmers and his friends also saw a chance to ecome involved again, and several trips were made nto the area, but prospecting regulations had changed ver the decades and the men discovered they had no gal claim to the deposit. The costs of registering e claims, and doing the work required to retain the ases, were prohibitive, and the men were unsuc-essful in finding corporate backers.

In the meantime, Alberta Research Council cientists further investigated the extent and nature f the deposits, and samples were taken. Premier teel took a 50-ton sample in 1957, and in co-oper-tion with ARC began work on finding an economic eans of upgrading the material. Premier Steel was bought out by Stelco in the '60's, but a new company -- Peace River Mining and Smelting -- continued its work, and set up a pilot plant at ARC facilities near Clover Bar, outside of Edmonton. Peace River Mining and Smelting also carried out extensive exploration drilling of the deposits, and the deposits near Moonshine Lake, and obtained a number of leases from the government. Economic consideration led the company to move east, to build an iron-making plant in Windsor, Ontario, but competition soon put Peace River Mining and Smelting out of business.

ARC personnel continued research intermittently, but large-scale development of the Clear Hills ore was rarely talked about for a number of years. World-wide steel shortages in the early '70's, however, made the prospect attractive again, and in 1973 the Alberta Department of Industry and Commerce began to look seriously at an integrated steel industry for the province. This has prompted the joint federal provincial research program which is now underway, and whether or not the discovery that Chalmers, Redfern and Lundstrom made back in 1924 bears fruit, will not be known until that program is completed.

Composition

Clear Hills iron ore has a complex mineral com-osition, making upgrading by conventional beneficiation procedures very difficult. The table below analyzes ore from the A and B blocks.



The ore is "oolitic"; that is, it consists of "oolites", fragments of quartz around which concentric layers of various minerals are deposited (somewhat akin to the process by which hailstones are formed). The ironbearing minerals are mainly goethite (Fe_2O_3 H_2O) and siderite ($FeCO_3$). The salient features revealed by the chemical analysis were:

1) Iron content averages between 32 and 36 per cent. As shown above, the Worsley deposit (block A) is of lower grade than the Rambling Creek deposit.

2) The silica and phosphorus content are relatively high, compared to other iron ores.

The high silica content is one of the major obstacles to an economically feasible beneficiation process; the ore's low iron content, and its complex composition, present problems which, although probably soluble in the long run, mean great expenditure in time and money before an answer can be found.

Research: The Key to the Future

Before they can be smelted, or used in a steelmaking process of any kind, most iron ores must be subjected to an upgrading procedure, in which the iron content is increased, and impurities such as silica either removed or substantially neutralized. As noted previously, this "beneficiation" process, or rather the lack of a suitable one, has been the chief economic barrier to undertaking development of the Clear Hills ore.

Numerous attempts have been made since the '50's to uncover such a process. As indicated in the previous chapter, these attempts could probably be collectively termed as "failures", especially when they were undertaken as part of a commercial operation. These failures, in combination with a non-encouraging environment of low steel prices, good scrap supplies, and slow technological progress in other parts of the world, meant that research has been intermittent and somewhat half-hearted over the years.

Interest was rekindled in 1973 by an improving market, a scrap shortage, and encouraging reports on new beneficiation techniques developed in Europe or the United States. The governments of Alberta and Canada accordingly embarked on a two-year, $400,000 joint research program, due to be completed late in 1976. The prime researchers were to be the Alberta Research Council, and the Department of Energy, Mines and Resources in Ottawa (known as CANMET).

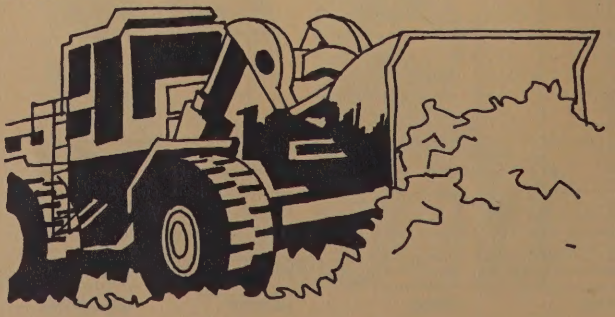
The technical details of the various beneficiation techniques examined by the two groups are probably beyond the needs of this information paper. They are discussed in considerable detail in the publications listed in the bibliography.

Suffice it to say that the research has been exhaustive, and the economically feasible alternatives have been narrowed down. Researchers, as early as September of 1975, indicated a "cautious optimism" that by the time their results are due at end of 1976, they will be able "to indicate a viable route for the commercial development of Peace River iron ore." They indicated, however, that success would only arrive with "a firm development commitment by private and public interests in Alberta."

If the economic climate remains favourable; if researchers are as successful as they hope; if adventurous developers can be found; and if the people of this region are enthusiastic, the Clear Hills ore may be developed, and the conjecture of the past twenty decades brought to fruition. These are a lot of "ifs", enough to ensure that if a way can be found, development is quite a way down the road.

Potential Impacts of Development

Ever since the "re-discovery" of the Clear Hills iron deposits in 1953, there has been a continual fascination with the possible benefits that development of the ores may bring to the people of the Peace. A multitude of communities, thanks in large part to their chambers of commerce and to politicians at all levels, have believed not only that development of the deposit is "imminent", but that their particular community would be one of the prime targets of whatever happy things took place.



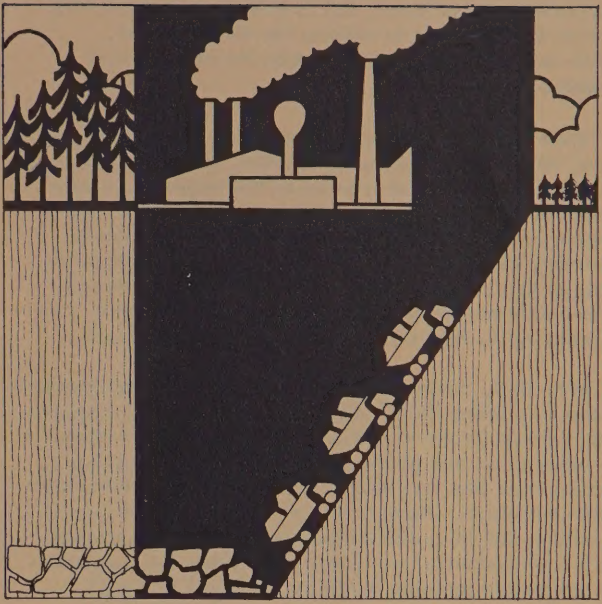
As should be clear from preceding chapters, how- r, it is most uncertain how, when and if the Clear ls ore will ever be exploited. Until the joint Al- ta Research Council -- CANMET research pro- m is concluded, we cannot know if there is even a e of such exploitation being economically feasible. still, hopes are high, and among those hoping are provincial government, which looks toward the ntual establishment of an integrated steel industry ot right in Alberta, at least in the prairie pro- ces. Understandably, another enthusiast is Im- ial Metals and Power Ltd., the present leasehold- on three of the four major deposits. In the follow- brief scenario of what may happen if the ore is eloped, the above two parties are the major sources information.

It has been stated previously that because of the ality and size of the deposit, Rambling or Swift eek is the likely site of the initial mining develop- nt in the Clear Hills. With over 200 million tons proven reserves, the B deposit will likely keep velopers busy for many years to come. Subse- ently, because of transportation links already es- lished to serve the B mine, and if the size and ality of their reserves are confirmed by drilling, C and D deposits will probably be next. The all, scattered A deposit north of Worsley will like- be the last to be mined.

Assuming then that Rambling Creek will be the st mine site, let us proceed to an examination of requirements of development in terms of both npower and other raw materials. The mine itself l be a strip mine, involving the removal of up to 0 feet of glacial till overburden. On the average, ree cubic yards of overburden will be removed for ch ton of iron ore extracted, and it would be used refill the adjoining mined-out pit. This process course necessitates the clearing of timber from mine site, timber that will require up to 100 ars to regenerate once the miners are gone.

Whatever beneficiation process is ultimately used, upgrading plant will probably be located right at mine site, since the shipping of raw ore is pro- bly uneconomical. In the initial construction phase, to 1,000 people may be needed at the site, in a ocess that will probably take three years at a total st of more than a hundred million dollars. During s phase, if past history is any judge, most of the rkers will live right on site in a construction camp.

Once the plant is built and the mining operation derway, about 400 permanent workers will be in- lved -- 100 or so in the mining operation, and out 300 in the beneficiation plant. Most of these l probably live at the other end of whatever trans- rtation links are built, and according to our sources, s will be in either Dixonville or Manning.



In interviews with both Don Park of the Alberta partment of Business Development and Tourism d with James Ball of Imperial Metals and Power, was stated that because of an easier grade, the w rail spur would probably go west from the Great Slave Lake Railway, rather than north from the N.A.R. railhead at Hines Creek. An Alberta Research Council report also states that "ore of the Swift Creek deposit would be most easily accessible from the east." Any upgraded road would likely follow the rail bed.

This is not to say that all Swift Creek workers will choose to live east. Some may decide to live south in I.D. 21, and commute over already existing forestry roads to the mine site. It should be mentioned that construction of the new transportation systems will also employ a great number of men, who may live in either on-site camps or in Mackenzie Highway communities.

Fuel for the beneficiation plant and mining operation seems readily available in or near the region. Good coking coal is available from McIntyre - Porcupine at Grande Cache, while sub-bituminous coal is in abundance (though undeveloped) in the Fox Creek area. There are also seams of sub-bituminous coal in the immediate vicinity, in the upper part of the Clear Hills, but the extent and mineability of these seams is unknown. Natural gas, and to a lesser extent crude oil, are available immediately south and west of the deposits in the Worsley and Boundary Lake fields.

If a smelter or steel-making plant is located in the region, limestone, dolomite and fireclay will be needed. Limestone and dolomite are to be found all along the Eastern Slopes, but the nearest mine to the Clear Hills is presently at Cadomin, 160 miles southwest of Edmonton. Good fireclay is being mined at Wabamun, 40 miles west of Edmonton.

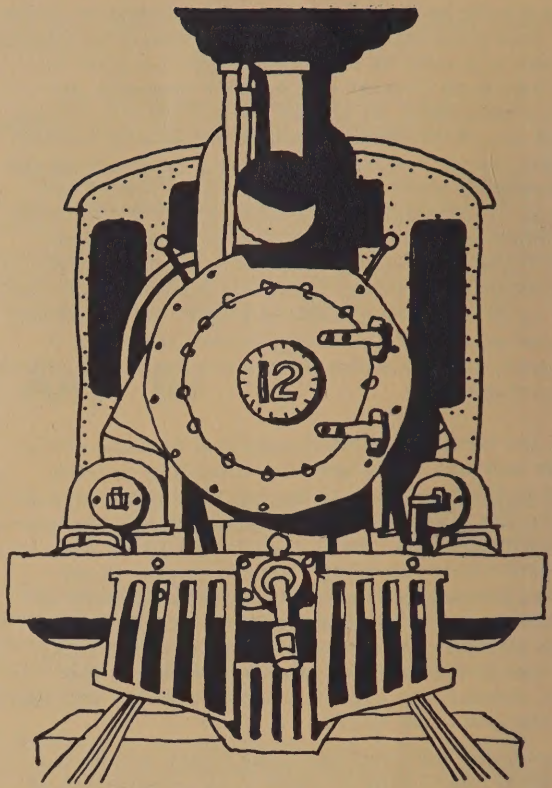
Water for all these operations can probably be provided by Swift Creek, with some sort of water control dam or weir installed. The Notikewin River may have to be utilized, but in either case care will have to be taken not to pollute the watercourse, which serves as the water supply for the Town of Manning.

There is no assurance, of course, even if the Clear Hills ore is ultimately mined, that the steelmaking plant would be located in the region. It may prove more economical to ship upgraded ore to Edmonton or points elsewhere. There is no question, however, that such a plant would give a considerable boost to the region if located here. It would employ up to 3,000 people during the construction phase, and as many as 1,200 on a permanent operating basis.

Mr. Ball, president of Imperial Metals and Power, stated in a letter dated July 17, 1975, that "it appears that it would be most economic to ship raw ore from the mine to an ore processing and steelmaking complex located at a site with a reasonably well developed infra-structure, which could be expanded to accommodate 1,000 to 1,200 employees ... without becoming a 'one-industry' or 'company' town. On this basis the preferred location would be the town of Peace River." Other communities are possibilities - Manning, for instance, claims to be fully prepared to take such an impact. But if the plant is located in the region, in whatever community, the impact may be distributed over a number of communities, since commuting is becoming more and more common practice.

It must be re-emphasized that all of the above possibilities are pure conjecture at the present time, educated guesses at best. It is certain that Imperial will not be able to establish the development on its own, and any other companies providing financing will have much to say about what goes where. The provincial and federal governments, who will probably be the builders of the new transportation links, will have considerable input into where they go.

Whatever the case, developers, researchers, and government will probably do all in their power to keep the regional population informed of their discoveries and plans. It is likely that whatever happens, will happen according to the people's wishes (tempered, of course, by some sort of economic rationale). Allowing those people who will bear the brunt of the impact to be part of the decision-making process, is becoming a very proper fashion in such major resource developments.



It should be said that because any development will be a good way down the road, communities or individuals who find the above projections disappointing, will have ample time to make their views known to any or all of the authorities concerned.

THANK YOU

The staff would like to thank the following for their invaluable assistance in the preparation of this report.

Mr. James Ball, Imperial Metals and Power, Vancouver

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In addition to the above papers, considerable information was gleaned from personal interviews and correspondence, as well as news articles from various publications.

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